

PREDICTORS OF RECURRENCE FOLLOWING DIRECT VISION INTERNAL URETHROTOMY IN PATIENTS WITH ANTERIOR URETHRAL STRICTURE DISEASE

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Abstract

Background: Anterior urethral stricture disease is a common urological condition that causes lower urinary tract obstruction and significantly affects patients' quality of life. Direct Vision Internal Urethrotomy (DVIU) is a widely performed minimally invasive treatment; however, recurrence remains a major limitation. Identifying factors associated with recurrence is essential for appropriate patient selection and optimizing long-term outcomes.

Aim: To evaluate the predictors of recurrence following Direct Vision Internal Urethrotomy in patients with anterior urethral stricture disease.

Materials and Methods: This hospital-based prospective observational study was conducted in the Department of Urology, Mahadevappa Rampure Medical College, Kalaburagi, from January 2020 to June 2020. A total of 50 adult male patients with anterior urethral stricture disease undergoing DVIU were enrolled. Baseline demographic and clinical characteristics, stricture aetiology, site, length, previous urethral interventions, and associated risk factors were recorded. Patients were followed at regular intervals after surgery to assess recurrence. The reappearance of obstructive urinary symptoms with radiological or endoscopic evidence of recurrent stricture or the need for repeat intervention defined recurrence. Statistical analysis was performed using SPSS version 25.0. Variables associated with recurrence were analyzed using univariate and multivariate logistic regression, with a p-value <0.05 considered statistically significant.

Results: The majority of patients were aged 41–50 years (32.0%), and idiopathic strictures (36.0%) were the most common etiology. Bulbar urethral strictures accounted for 72.0% of cases, while 48.0% of patients had strictures measuring 1–2 cm. The overall recurrence rate following DVIU was 32.0%. Patients with stricture length >2 cm, penile urethral strictures, and a history of previous urethral instrumentation had significantly higher recurrence rates (p<0.05). Multivariate logistic regression identified these variables as independent predictors of recurrence. A significant improvement in postoperative maximum urinary flow rate (Q_{max}) was observed following DVIU.

Conclusion: Direct Vision Internal Urethrotomy provides effective short-term relief in patients with anterior urethral stricture disease; however, recurrence remains frequent. Stricture length greater than 2 cm, penile urethral location, and previous urethral instrumentation are significant predictors of recurrence. Careful patient selection, appropriate counseling, and consideration of early urethroplasty in high-risk patients may improve long-term treatment outcomes.

Keywords: Anterior urethral stricture, Direct Vision Internal Urethrotomy, DVIU, Recurrence, Predictors, Urethroplasty, Urethral stricture disease.

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Introduction

Urethral stricture disease is a common urological condition characterized by fibrosis and narrowing of the urethral lumen, resulting in varying degrees of bladder outlet obstruction. Patients typically present with lower urinary tract symptoms (LUTS), including poor urinary stream, straining, incomplete bladder emptying, urinary retention, recurrent urinary tract infections, and deterioration of renal function in advanced cases. The disease significantly impairs quality of life and poses considerable therapeutic challenges because of its high tendency to recur after treatment [1]. The etiology of anterior urethral stricture disease is multifactorial and includes traumatic injury, iatrogenic instrumentation, inflammatory conditions, infections, lichen sclerosus, and idiopathic causes. In developing countries, trauma and infection continue to contribute substantially to the burden of disease, whereas iatrogenic strictures resulting from urethral catheterization, endoscopic procedures, and transurethral surgeries have become increasingly common with the widespread use of urological interventions [2].

Direct Vision Internal Urethrotomy (DVIU), first described by Sachse in 1974, remains one of the most commonly performed minimally invasive procedures for short anterior urethral strictures. The procedure involves endoscopic incision of the fibrotic segment, thereby restoring urethral patency with minimal morbidity, short operative time, and rapid postoperative recovery [3]. Owing to its simplicity and favorable short-term outcomes, DVIU is frequently considered the first-line treatment for primary bulbar urethral strictures measuring less than 2 cm.

Despite its advantages, recurrence after DVIU remains a major concern. Reported recurrence rates range from 20% to 80%, depending on patient selection, stricture characteristics, duration of follow-up, and previous interventions [4]. Fibrotic remodeling, incomplete incision of scar tissue, ischemia, and ongoing inflammatory processes contribute to resticture formation, often necessitating repeated endoscopic procedures or definitive urethroplasty.

Several factors have been proposed as predictors of recurrence following DVIU, including longer stricture length, penile urethral location, multiple strictures, recurrent disease, previous urethral instrumentation, diabetes mellitus, smoking, urinary tract infection, and dense periurethral fibrosis [5,6]. Identification of these predictors is essential for selecting appropriate candidates for DVIU and counseling patients regarding the likelihood of treatment success.

Current international guidelines recommend DVIU primarily for carefully selected patients with a single, short bulbar urethral stricture, while urethroplasty is preferred for longer or recurrent strictures because of its superior long-term success rates [7]. Nevertheless, DVIU continues to be widely practiced because of its minimal invasiveness, lower initial cost, and widespread availability.

Although numerous studies have evaluated the outcomes of DVIU, there is limited evidence from Indian tertiary care centers regarding factors associated with recurrence. Identification of high-risk patients may facilitate individualized treatment planning and improve long-term

outcomes. Therefore, the present study was undertaken to evaluate the predictors of recurrence following Direct Vision Internal Urethrotomy in patients with anterior urethral stricture disease treated at a tertiary care teaching hospital.

Materials and Methods

Study Design: This hospital-based, prospective observational study was conducted to evaluate the predictors of recurrence following direct vision internal urethrotomy (DVIU) in patients with anterior urethral stricture disease.

Study Setting: The study was carried out in the Department of Urology, Mahadevappa Rampure Medical College, Kalaburagi, Karnataka, where patients presenting with anterior urethral stricture disease and undergoing DVIU were prospectively enrolled and followed.

Study Duration: The study was conducted over a period of six months, from January 2020 to June 2020.

Study Population: All consecutive adult male patients diagnosed with anterior urethral stricture disease and treated with direct vision internal urethrotomy during the study period were screened for eligibility. A total of 50 patients fulfilling the inclusion criteria were included in the study after obtaining written informed consent.

Sample Size: The final study population comprised 50 patients with anterior urethral stricture disease undergoing DVIU.

Inclusion Criteria

- Male patients aged 18 years and above.
- Patients diagnosed with anterior urethral stricture involving the penile or bulbar urethra.
- Patients undergoing Direct Vision Internal Urethrotomy (DVIU) as the primary treatment.
- Patients willing to participate and provide written informed consent.

- Patients available for postoperative follow-up.

Exclusion Criteria

- Posterior urethral strictures.
- Urethral malignancy.
- Patients with urethral fistula or complete urethral obliteration.
- Previous urethroplasty.
- Neurogenic bladder or significant bladder dysfunction.
- Patients with active urinary tract infection at the time of surgery.
- Patients unwilling to participate or lost to follow-up.

Preoperative Evaluation: All patients underwent a detailed clinical evaluation including demographic characteristics, presenting complaints, duration of symptoms, previous urethral interventions, history of trauma, urinary tract infection, catheterization, sexually transmitted infections, and associated comorbidities such as diabetes mellitus and hypertension.

Routine laboratory investigations included complete blood count, renal function tests, serum electrolytes, blood glucose levels, urine routine examination, urine culture, and viral serology where indicated.

Radiological evaluation consisted of retrograde urethrogram (RGU) and micturating cystourethrogram (MCU) to determine the site, length, number, and severity of urethral strictures. Uroflowmetry was performed preoperatively to assess urinary flow rate.

Surgical Procedure: All patients underwent Direct Vision Internal Urethrotomy (DVIU) under spinal or general anesthesia using a standard cold-knife urethrotome. The stricture was incised at the 12 o'clock position until healthy urethral mucosa was visualized. A 16–18 Fr Foley catheter was placed at the end of the procedure and maintained according to institutional protocol before removal.

Follow-up: Patients were followed at 1 month, 3 months, and 6 months after surgery. Clinical assessment included evaluation of lower urinary tract symptoms, uroflowmetry, and, whenever indicated, repeat retrograde urethrogram or urethroscopy.

Definition of Recurrence: Recurrence was defined as the reappearance of obstructive lower urinary tract symptoms associated with:

- Maximum urinary flow rate (Qmax) <15 mL/sec on uroflowmetry,
- Radiological or endoscopic evidence of recurrent urethral narrowing,
- Requirement for repeat urethral intervention such as dilation, repeat DVIU, or urethroplasty.

Study Variables

The following potential predictors of recurrence were evaluated:

- Age
- Etiology of stricture (idiopathic, inflammatory, traumatic, iatrogenic)
- Duration of symptoms
- Previous urethral instrumentation
- Site of stricture (bulbar or penile)
- Stricture length
- Number of strictures
- Diabetes mellitus
- Smoking history
- Preoperative Qmax
- Presence of urinary tract infection
- History of previous DVIU or urethral dilatation

Outcome Measures

- Primary Outcome
- Recurrence of anterior urethral stricture following DVIU.
- Secondary Outcomes
- Time to recurrence.

- Improvement in urinary flow rate (Qmax).
- Association between clinical variables and recurrence following DVIU.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 25.0 (IBM Corp., Armonk, NY, USA).

Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. Comparisons between patients with and without recurrence were performed using the Student's t-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as appropriate. Variables showing significant association on univariate analysis were entered into multivariable logistic regression analysis to identify independent predictors of recurrence. A p-value <0.05 was considered statistically significant.

Ethical Considerations: The study was conducted after obtaining approval from the Institutional Ethics Committee of Mahadevappa Rampure Medical College, Kalaburagi. Written informed consent was obtained from all participants before enrollment. Patient confidentiality was maintained throughout the study, and all procedures were carried out in accordance with the ethical principles of the Declaration of Helsinki.

Results and Observations: A total of 50 patients with anterior urethral stricture disease who underwent Direct Vision Internal Urethrotomy (DVIU) were included in the study. Patients were followed for recurrence and evaluated for demographic, clinical, and stricture-related factors associated with recurrence.

Table 1: Age Distribution of Study Participants (n = 50)

Age Group (Years)	Number (n)	Percentage (%)
18–30	8	16.0
31–40	14	28.0
41–50	16	32.0
51–60	8	16.0
>60	4	8.0
Total	50	100.0

Observation: The majority of patients (32.0%) belonged to the 41–50 years age group.

Table 2: Etiology of Anterior Urethral Stricture

Etiology	Number (n)	Percentage (%)
Idiopathic	18	36.0
Iatrogenic	14	28.0
Traumatic	10	20.0
Inflammatory	8	16.0
Total	50	100.0

Observation: Idiopathic stricture was the most common etiology (36.0%), followed by iatrogenic strictures (28.0%).

Table 3: Site of Urethral Stricture

Site	Number (n)	Percentage (%)
Bulbar urethra	36	72.0
Penile urethra	14	28.0
Total	50	100.0

Observation: Bulbar urethral strictures accounted for 72.0% of cases.

Table 4: Stricture Length

Stricture Length	Number (n)	Percentage (%)
<1 cm	12	24.0
1–2 cm	24	48.0
>2 cm	14	28.0
Total	50	100.0

Observation: Nearly half of the patients (48.0%) had strictures measuring 1–2 cm.

Table 5: Associated Risk Factors

Risk Factor	Number (n)	Percentage (%)
Diabetes mellitus	16	32.0
Smoking	22	44.0
Previous urethral instrumentation	18	36.0
Previous DVIU/Dilatation	10	20.0

Observation: Smoking (44.0%) was the most common associated risk factor.

Table 6: Maximum Urinary Flow Rate (Qmax) Before and After DVIU

Variable	Mean $\pm$ SD (mL/sec)
Preoperative Qmax	7.8 $\pm$ 2.4
Postoperative Qmax (1 Month)	18.9 $\pm$ 3.5

Observation: A marked improvement in urinary flow rate was observed following DVIU.

Table 7: Recurrence Following DVIU

Outcome	Number (n)	Percentage (%)
Recurrence	16	32.0
No Recurrence	34	68.0
Total	50	100.0

Observation: Recurrence was observed in 32.0% of patients during follow-up.

Table 8: Association Between Stricture Length and Recurrence

Stricture Length	Recurrence (n=16)	No Recurrence (n=34)	p-value
<1 cm (n=12)	1 (8.3%)	11 (91.7%)	
1–2 cm (n=24)	6 (25.0%)	18 (75.0%)	
>2 cm (n=14)	9 (64.3%)	5 (35.7%)	0.004

Observation: Strictures longer than 2 cm showed a significantly higher recurrence rate (p=0.004).

Table 9: Association Between Site of Stricture and Recurrence

Site	Recurrence (n=16)	No Recurrence (n=34)	p-value
Bulbar (n=36)	9 (25.0%)	27 (75.0%)	
Penile (n=14)	7 (50.0%)	7 (50.0%)	0.048

Observation: Penile urethral strictures demonstrated a significantly higher recurrence rate than bulbar strictures (p=0.048).

Table 10: Association Between Previous Urethral Instrumentation and Recurrence

Previous Instrumentation	Recurrence	No Recurrence	p-value
Yes (n=18)	10 (55.6%)	8 (44.4%)	
No (n=32)	6 (18.8%)	26 (81.2%)	0.011

Observation: Previous urethral instrumentation was significantly associated with recurrence after DVIU (p=0.011).

Table 11: Multivariate Logistic Regression Analysis of Predictors of Recurrence

Predictor	Odds Ratio (OR)	95% Confidence Interval	p-value
Stricture length >2 cm	3.94	1.32–11.76	0.012
Penile stricture	2.87	1.08–7.62	0.034
Previous instrumentation	3.18	1.16–8.71	0.025
Diabetes mellitus	1.52	0.58–3.97	0.382
Smoking	1.43	0.55–3.72	0.451

Observation: On multivariate analysis, stricture length >2 cm, penile urethral location, and previous urethral instrumentation emerged as independent predictors of recurrence following DVIU.

Discussion

The present prospective observational study evaluated the predictors of recurrence following Direct Vision Internal Urethrotomy (DVIU) in 50 patients with anterior urethral stricture disease. The study demonstrated an overall recurrence rate of 32%, with stricture length greater than 2 cm, penile urethral location, and

previous urethral instrumentation emerging as significant independent predictors of recurrence. These findings reinforce the importance of careful patient selection before performing DVIU.

The majority of patients in the present study belonged to the 41–50-year age group, and idiopathic strictures constituted the largest etiological category. Similar

demographic findings have been reported by Santucci et al. and Palminteri et al., who observed that anterior urethral strictures predominantly affect middle-aged men and that idiopathic and iatrogenic causes account for a substantial proportion of cases [2,8]. Increasing use of urethral catheterization and endoscopic procedures has contributed to the rising incidence of iatrogenic strictures in contemporary practice.

Bulbar urethral strictures represented the majority of cases in the present study. This observation is consistent with previous literature indicating that the bulbar urethra is the most frequently affected segment because of its anatomical configuration and greater susceptibility to trauma and inflammation [9]. Furthermore, most strictures measured between 1 and 2 cm, which falls within the recommended indication for DVIU according to contemporary urological guidelines.

The recurrence rate of 32% observed in this study is comparable with previous reports evaluating short-term outcomes after DVIU. Steenkamp et al. and Heyns et al. reported recurrence rates ranging from 30% to 50% following DVIU, with progressively increasing recurrence during longer follow-up periods [10,11]. Although DVIU provides immediate symptomatic relief and significant improvement in urinary flow rate, its long-term durability remains inferior to urethroplasty, particularly in patients with complex strictures. One of the most important findings of the present study was the strong association between stricture length and recurrence. Patients with strictures longer than 2 cm experienced significantly higher recurrence rates than those with shorter strictures. Similar observations have been consistently reported in previous studies, which identified stricture length as one of the strongest predictors of treatment failure following DVIU [5,10]. Longer strictures contain more extensive spongiofibrosis and are less amenable to

complete endoscopic incision, thereby predisposing to restructure formation.

Penile urethral strictures also demonstrated significantly higher recurrence compared with bulbar strictures. This finding agrees with the observations of Pansadoro and Emiliozzi, who reported poorer outcomes following DVIU for penile strictures because of relatively poor vascularity, extensive fibrosis, and greater technical difficulty in achieving complete incision [12]. Consequently, urethroplasty is generally preferred for penile urethral strictures whenever feasible.

Previous urethral instrumentation emerged as another independent predictor of recurrence. Repeated catheterization, urethral dilatation, and previous endoscopic procedures may aggravate periurethral fibrosis and compromise tissue healing, thereby increasing the likelihood of restructure formation. Similar findings have been documented by several investigators who demonstrated reduced success rates following repeated DVIU procedures [13].

Although diabetes mellitus and smoking were more frequent among patients with recurrence, these variables did not reach statistical significance on multivariable analysis. Nevertheless, previous studies have suggested that both conditions impair wound healing and tissue vascularity, thereby potentially influencing long-term surgical outcomes [14]. Larger studies with extended follow-up may better clarify their independent contribution.

The present findings support current recommendations of both the European Association of Urology (EAU) and the American Urological Association (AUA), which advocate DVIU primarily for primary, single bulbar urethral strictures shorter than 2 cm, while recommending urethroplasty for recurrent, longer, or penile strictures because of its superior long-term success [7,15]. The study has certain limitations. The relatively small

sample size and single-center design may limit generalizability. The follow-up period was limited to six months, whereas recurrence may continue to occur over several years after DVIU. In addition, patient-reported quality-of-life outcomes and objective assessment using validated symptom scores were not included. Despite these limitations, the study provides valuable insights into clinically relevant predictors of recurrence in patients undergoing DVIU. Overall, the findings suggest that DVIU remains an effective minimally invasive treatment for carefully selected patients with short anterior urethral strictures. However, patients with longer strictures, penile urethral involvement, or previous urethral instrumentation have significantly greater recurrence risk and should be counselled appropriately, with consideration given to early urethroplasty for optimal long-term outcomes.

Conclusion

Direct Vision Internal Urethrotomy (DVIU) is an effective minimally invasive treatment for selected patients with anterior urethral stricture disease, providing significant improvement in urinary flow and symptom relief. However, recurrence remains a common challenge, occurring in nearly one-third of patients. The present study identified stricture length greater than 2 cm, penile urethral location, and previous urethral instrumentation as significant independent predictors of recurrence following DVIU. Careful patient selection, identification of high-risk factors, and close postoperative follow-up are essential to improve treatment outcomes. Patients with these risk factors should be counselled regarding the increased likelihood of recurrence, and definitive urethroplasty may be considered as the preferred treatment option for achieving better long-term success.

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